Can mammals mediate climatically-induced vegetation transitions in alpine ecosystems of the western United States?

Principal Contact: Robert Klinger

Our study addresses the general question of the degree to which wildlife species can adapt to, or possibly even modify, effects from climate change. We are focusing on five species of mammals in the alpine zone of the Sierra Nevada mountain range, including the federally endangered Sierra Nevada bighorn sheep and the American pika, a species recently proposed for listing because of loss of populations from altered climatic conditions. It is expected that there will be an upward expansion of trees and shrubs from lower elevations and that many or even most alpine meadows will be converted to woody dominated communities. Meadows provide critical habitat for many alpine mammal species, and their conversion could represent a major loss with severe consequences for the long-term persistence of these species. However, it is currently unknown whether the severity of the effects of meadow conversion on alpine mammals would be uniform or species-specific; all species could be impacted similarly, some species could be unaffected, or species currently not considered at risk may be seriously impacted. Moreover, while climate could *potentially* trigger changes in alpine vegetation communities, herbivorous and granivorous mammals could mediate the magnitude and extent of meadow conversion through their consumption of woody seeds and seedlings. In other words, feedbacks between climate and alpine mammals could result in the mammals "managing their own habitat." Presently though, very little is known about vegetation or mammal communities in the alpine zone of the Sierra Nevada, especially in relation to climate change. Consequently, resource management agencies are seriously hindered in development of justifiable, long-term management strategies for bighorn sheep, pika, and other alpine mammals.

Our study will be the first to systematically begin to bridge the gaps in knowledge of climate effects on alpine mammals and their habitats throughout the Sierra Nevada. Our collaborators in this effort include the U.S. Fish & Wildlife Service (FWS), the California Department of Fish & Game (CDFG), the National Park Service (NPS), U.S. Forest Service (USFS), two University of California campuses (UC Davis and UC Merced), and California State University San Luis Obispo. Our three principal goals are to: (1) use ground-based surveys and remote sensing data to develop models of the contemporary ranges for the five species; (2) use a combination of field experiments and ground-based surveys to evaluate the degree to which plant-animal interactions may alter transitions of alpine meadows to woody dominated communities; and, (3) use data from the field experiments and ground-based surveys to develop and compare models of projected range shifts with and without incorporation of the effect the mammals have on meadow conversion. The critical aspect of this approach is the testing of multiple models of projected vegetation transitions with and without variables representing shifts in mammal ranges and

feedbacks from herbivory and granivory. The reports, peer-reviewed publications, and models we produce with our university partners will enable us to provide our agency partners with the likelihood of alternative scenarios of direct and indirect effects of climate change on multiple alpine mammal species.